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by Thomas deS. Furman

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ECONOMIC ASPECTS OF SANITARY ENGINEERING AND SANITATION¹

Thomas deS. Furman
Assistant Professor of Civil Engineering
University of Florida

Whether he is young or old, black or white, rich or poor, each individual to some degree feels the rising costs of labor and material in this complex civilization of today. The newspapers and magazines have made much of the "higher cost of living" until it is a common phrase in our everyday conversation. The housewife knows how it affects her budget, the business man, his accounts, but seldom do we realize the tremendous pressure it is bringing to bear on the economic foundations of our civilization. The rising costs of construction, operation, maintenance, and labor are causing the tax payers of the towns and cities of our nation to view with alarm the ever-increasing costs of municipal government.

The results of the past presidential election have been interpreted by some authorities as a mandate of the people to reduce the expenditures of the federal government, and it is believed that this change in heart will be felt by state and local governments as well.

If this is true, as there is good reason to believe, it will only be a matter of time before our local municipal governments will find themselves on the horns of a dilemma--the increasing cost of government on one hand and the growing pressure to reduce these expenditures on the other. To illustrate the upward spiral of construction costs, Figure I has been prepared and is a plot of the Engineering News-Record's construction index for the past three and one-half years. It can be seen that during this period the cost index has risen until it is now 589.21 percent above the 1913 cost base of 100. Even the great advances of recent years in construction methods, materials and equipment have not succeeded in bringing down this upward trend in construction costs.

Increasing the gravity of the situation is also the unprecedented growth of the cities of the nation, caused in part by the migration of the population from farms and rural communities to urban areas. The Florida League of Municipalities estimates, for example, that by 1960 eighty percent of this state's population will live within the limits of some municipality. Figure II shows the population increase of four groups of American cities. In this chart the average population of the group in 1900 has been taken as a base and the increase in population plotted as a percent of that figure. Line A is an average of 100 cities having a population greater than 100,000 in 1950. Line B is the average of the 25 cities that lie within the 13 southern states. Line C is the average for the 15 cities which lie within the 5 Gulf Coast states and Line D is a plot of the growth of the three Florida cities, Jacksonville, Tampa, and Miami, which make up the original group. It will require only a brief inspection to visualize the facts and realize the situation which is developing.

¹ Paper presented before the ASCE Sanitary Engineering Division at the Miami Beach Convention, Miami Beach, Florida, June 18, 1953

While the average for the 100 cities has increased by 152 percent in the last 50 years, southern cities have increased 408 percent, the Gulf coast cities by 509 percent, and the Florida cities by 1180 percent.

The rapidly expanding population, concentrated more and more in the towns and cities of America, is aggravating the already overtaxed sanitary facilities of these municipalities. Before the development of our modern modes of transportation these cities were more or less compact units which could be circumscribed by definite limits. Today these limits barely surround the business and industrial sections of the cities and the majority of the population lives beyond this area in sprawling developments which seem to spring up almost over night.

In some instances, these developments are built by realtors who are interested only in capitalizing on this influx of rural people trying to get to the city and the urban population trying to get out. Their primary interest is in constructing a building which will protect its inhabitant from the weather and provide ingress and egress for the family car. A water system is provided which is adequate, granting that nobody else on the block is using water at that particular time. Sewage disposal is accomplished either by a septic tank on the premises or by some sort of packaged treatment unit located on a lot which was unfit for building purposes. As long as the realtor has money tied up in the development, reasonable care is taken of this facility, but as soon as he steps out of the picture the plant and its operation rapidly deteriorate. Garbage disposal is taken care of by each family on its Sunday drive in the country. The weekly accumulation of garbage is neatly packaged and dumped on some lonely stretch of road. Fly, mosquito, rodent control and other phases of sanitation are not considered. While health departments are constantly alert to forestall such developments they are often unable to prevent construction. Eventually, however, the health department or organized and indignant citizens will exert pressure on the city to alleviate these health hazards. If the development is beyond the city limit, local action is likely to result in the hasty formation of a sanitary district.

Not to provide adequate sewage disposal, garbage collection, a portable water supply, fly, mosquito and rodent control for these areas would be sheer folly, but to provide these facilities in the face of high costs of labor and materials is almost a financial impossibility without wholehearted support of the population involved.

This fact is borne out by the experience of the Miami Sewage Treatment Board which found that the cost of sewage treatment is not stable. A system which would have been adequate for Miami in 1940 could have been built for 17 million dollars, but facilities to provide the same degree of treatment today would cost in the neighborhood of 30 million. There seems to be no end to this upward spiral of the costs of sanitary facilities, but there does seem to be a limit to the amount the taxpayers are able or willing to pay. The city of Jacksonville, Florida is faced with this very problem. Nor is Florida unique in this respect. Turn to any engineering magazine and you can find in almost every issue accounts of similar situations existing throughout the nation, and as a result of these trends the Sanitary and Public Health Engineer may soon find himself priced out of business.

These factors, the rising costs of labor and materials, the rapid growth of towns and cities in both area and population, and the growing reluctance toward increased taxes, present an economic problem to the sanitary engineering profession for which there is no stock solution. The issues involved are numerous and too closely bound up with our complex way of life to be

solved by simple formulae. These same problems are vexing the best minds of the country and certainly many ramifications lie beyond the scope of this paper. However I would like to offer four ways which may alleviate the situation. They are education, research, better engineering, and more mechanization.

Education is certainly the first and most important step. Mr. and Mrs. John Q. Public must be taught to appreciate the importance and value of an adequate sanitary program. Until they are sold on the idea it will be difficult to accomplish significant results in the field of public health. In reality the sanitary and public health engineers are selling a priceless commodity--Health. In comparison, all other commodities seem trivial, and yet a few dollars often influence decisions affecting the health and well-being of a community. In order to sell, the desire to buy must be created. It has been said that a good salesman is someone who can make you think you wanted something all your life which actually you heard of only five minutes before. Thus there are two groups which must receive immediate attention--first is the adult public, which must be educated to the point where it will desire the benefits which can be derived from a good sanitary program; and, second, the sanitary engineer and sanitarian, who must receive training which will make them better salesmen. There is another group which should receive adequate training in the immediate future--the younger generation, the junior and senior high school students. It is this group of young people who can do more to improve the public health situation of the future than the other two combined. Max Planck, one of the world's eminent nuclear physicists, said in his autobiography that "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it." Fifteen years from today a large share of the burden of government will rest upon the shoulders of these young people. They will be the ones who will be setting the policies and paying the taxes. If they can be trained now to appreciate the value of an intelligent public health program they will grow up with the desire to live in a world free of water-borne diseases, free from flies, mosquitoes, roaches, and rats, free from garbage piles and from malodorous, ill kept sewage treatment plants. If they have the desire they will be willing to supply the money and the brains to do the job.

There is still another group which must be better trained if economy is to be practiced in the operation and maintenance of water and sewage treatment plants of this nation. These are the operators of the water and sewage treatment plants. Too long have city and consulting engineers left this burden to the state health departments. There is an urgent need for these engineers to get behind the health department in insisting that the operator of even the smallest plant become certified. Schools have been set up in practically every state to train these operators. Florida and South Carolina have recently joined the ranks of those who offer correspondence courses in plant operation, management and techniques so that the operator can do his studying at home. Education of these men are steps in the right direction, but it needs the impetus which consulting and city engineers can give by their wholehearted support.

Research

Another step which must be taken is in the field of research. Few will deny that the great progress which has been made in recent years in the fields of communications, transportation, medicine, and atomic energy has been due in large measure to the amount of basic and applied research which has been done in those fields. Sanitary engineering and sanitation, while not

the newest of these, is certainly in its infancy. Those in research are the first to acknowledge that only a beginning has been made in uncovering and understanding the basic truths involved in water and sewage treatment. In spite of all the work that has been done, our basic concepts have advanced but little over the past 100 years. The trickling filter, which is probably the most widely used method of sewage treatment, is but a short step from the sand filter used by Frankland in 1865. Our most modern water treatment plant is only a stone's throw from the methods used by the Chinese 3000 years ago. Sanitary land fill, the last word in garbage disposal, was practiced in the early civilizations. We have been traveling a long time but the distance we have covered is relatively small.

Research in any field is expensive and in the field of sanitary engineering there is no "big brother" organization to sponsor such work, no Infantile Paralysis Foundation, no Damon Runyon Fund, no Community Chest. What research is being done is sponsored by equipment manufacturers, sewage plant operators, a few universities and health departments scattered over the nation, and the Federal Government. Lack of coordination and free exchange of information is a serious handicap. Most of the work being done today is applied research, the kind which will yield the quickest return on the money invested. Basic research has been sadly neglected, yet it is upon this foundation that applied research must be developed. If significant progress is to be made more people must begin thinking about ways and means of developing a broad program of both basic and applied research.

The University of Florida can boast of what is believed to be a unique example of an enlightened approach to this problem. The Winn-Lovett Grocery Company of Jacksonville is sponsoring a five-year program in the field of sanitary research as a public service. The aim of this program is to reduce the cost of sewage treatment for Florida communities, and significant progress has been made. Research is not the only field in which this firm is active. They also sponsor six scholarships each year for students who wish to study in the field of Municipal and Public Health Engineering. It is hoped that this is only the beginning. The citizens, the companies, and the corporations of this nation must be brought to realize the gravity of the situation and the vast amount of work yet to be done in this most important field. When this has been done the money for this work will be forthcoming.

The two approaches mentioned have been long range programs, work which will not yield tangible results for many years to come. The best solution for the present lies in better engineering and better use of mechanical equipment.

Engineering

The terms engineering and economy have, in recent years, become almost synonymous in meaning to the general public. The goal of the engineer is to satisfy the desires of man at a minimum expenditure of human effort and material; which is, in fact, not a bad definition of economy. However, in order to achieve this goal, the engineer must be placed in a position where he can be of service. Too often the engineer finds himself in the same position as the doctor who isn't called until the situation is desperate and then cure is both difficult and costly. Advanced planning is one answer to this problem. It is this type of planning which returns many fold the cost of the original investment in better service at lower costs, yet it is almost impossible to convince a city government that this is true. If the administrators of municipal governments would only obtain and follow such an overall plan, prepared by a competent engineer, many of the vexing problems

which face the sanitary departments of many cities would be avoided. In reality this is another problem in education, and it seems logical that local chapters of the A. S. C. E. could render a great service to their profession and fellow men by undertaking this type of educational program.

Substantial savings often result when critical attention is given to old established design standards in planning sanitary facilities. This is especially true of sewage treatment facilities in southern states where temperature plays an important role. "Design Standards are devices to keep the lazy mind from thinking" was a favorite phrase of the late Earle B. Phelps and it can be well applied to many engineers. Too many of the smaller plants do not receive the careful design which results in a material saving of construction costs.

Lack of understanding and appreciation of the problems involving plant operation and maintenance is another fault which has been laid at the feet of the engineer. Once construction has been completed the designer forgets the problem, but the operator has to live and work with the poor designs and arrangements for years to come.

European and South American designers have often accused American engineers of being too lavish with concrete and steel. "Monument builder" is an epithet which can be thrown at many engineers with justification. There are too many engineers who have tried to substitute gadgets for operational knowhow. Too many filter galleries are as ornate as a modern hotel lobby with Tennessee marble, flashing lights, and gaudy gadgets. These things cost money both to buy and to maintain, and unless they improve the operation of the plant they are a liability rather than an asset. While some will contend that embellishment has an aesthetic value it is doubtful if the taxpaying public willingly supports this view to any substantial degree. There is no reason why a water or sewage treatment plant should not be as simple and functional in construction and operation as a power sub-station or gasoline cracking plant. Why should an engineer have the right to spend public funds dressing up a municipal facility with items which will neither improve the quality of the service nor facilitate plant operation, and some believe that an engineer guilty of such practice is as guilty of misuse of public funds as the office holder who uses public money to play the horses. The fact should be remembered that each dollar saved in planning and construction is worth almost two at the end of the period of indebtedness.

More economy in plant operation and management should be practiced. Small sums spent on upkeep and maintenance often prevent costly repairs. It has been said that most honest efforts to reduce the costs of plant operation have resulted in success and occasionally in the discovery of a saleable byproduct. In Richmond, Indiana, for example, the sludge digester capacity was increased to permit the addition of ground garbage and it was found that the additional gas produced was worth approximately seven thousand dollars per year. The City of Miami installed a lime recalcining plant to utilize the water plant sludge and found that it could supply the 18,000 tons of lime required by the Hialeah and Southwest plants at a saving in cost of over a hundred thousand dollars per year.

Mechanical Equipment

Another possible solution to the immediate problem is the judicious use of mechanical equipment. By mechanical equipment is meant equipment which will reduce the labor payroll and not the packaged automatic treatment units which have caught the fancy of several equipment manufacturers. Simple arithmetic will show that forty thousand dollars borrowed at three percent interest can be amortized over a period of 20 years with a payment of

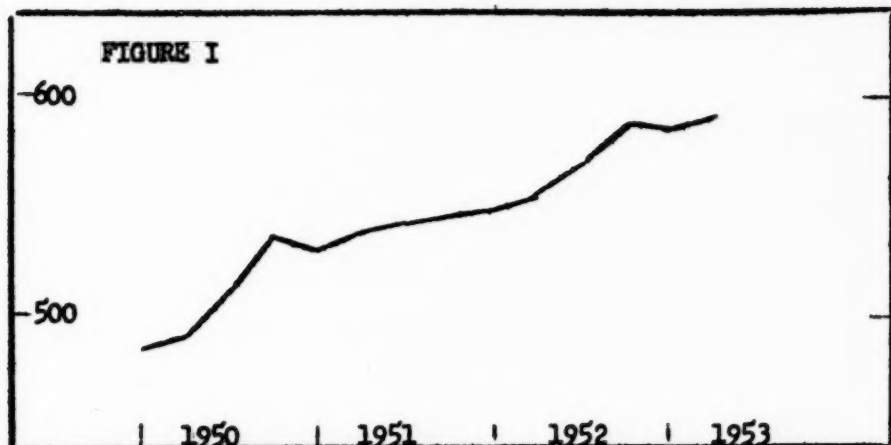
twenty-five hundred dollars per year. If the installation of equipment would eliminate the necessity of employing one semi-skilled laborer the department involved would save money.

The use of household garbage grinders in community-wide installations, for example, holds forth promise in reducing the cost of garbage collection and disposal. The intelligent use of load-packer type trucks in trash collection, mechanical convertors and elevators in handling bulky material, and many other such pieces of labor saving equipment on the market today will often mean the difference between operating within a limited budget or at a deficit.

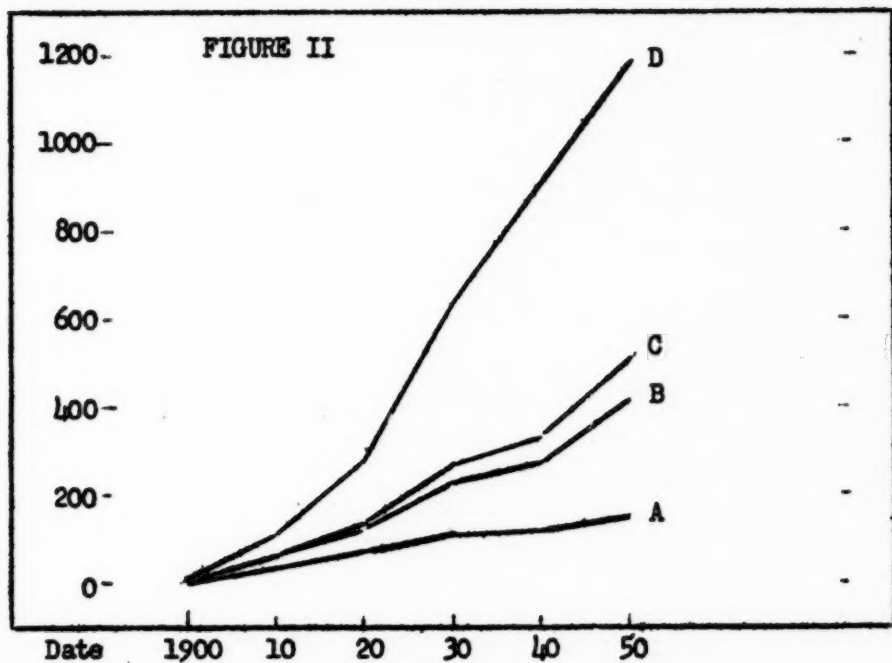
Summary

This paper might have been filled with a mass of supporting figures, but they would only prove a point which is obvious. As Dr. Kettering of General Motors has said, "You don't need six pages of mathematics to prove the law of thermodynamics which says that you can't push on anything that is going faster than you are." The economic aspects of sanitary engineering and sanitation are just as obvious. The point is being reached where the public is weighing the costs and benefits of these services and facilities. In matters where the health of the public is affected this is a dangerous attitude. Something must be done and it is the duty of the engineer to interpret the significance of sanitary engineering technology. This can be done by education. By research, new and better methods of treatment and disposal can be discovered, and through better engineering, the costs of construction, maintenance, and operation can be reduced.

The economic problems which face the sanitary engineering profession are difficult but not insurmountable. The solutions will require work, ingenuity, imagination, and ability. If the members of the profession are unwilling to extend the effort the future holds little, but if they will work toward the solution of these problems with determination and perseverance the future holds great promise.



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